DISCUSSION
Chapter-V

DISCUSSION

Integration of plant pesticides in recent concept of insect pest management seems to be most appropriate proposition because of their negligible mammalian toxicity and biodegradability in nature, besides, plant origin pesticides particularly, neem based formulations are harmless to beneficial insects including Predator's and Pollinators because of their specific action with respect to the development of insect pest concerned. In general, these neem based pesticides do not pose the problem of insect resistance, resurgence and the risk of environmental pollution which is a matter of top priority of the day at the international level despite the fact that these pesticides have bright perspectives there is dearth of information with special reference to phytophagous and storage pests.

In view of the above facts, the insecticidal, antifeedant and juvenomimetic effects of different neem based pesticides have been tested against two experimental insects, viz., Cadra cautella Walk and Papilio demoleus Linn. Besides the persistance against phytophagous pest, P. demoleus. The results thus obtained on
various aspects of present investigations have been discussed critically in the light of earlier findings under the following heads.

5.1 Insecticidal Properties of neem based pesticides

Result on insecticidal properties of five neem based pesticides (Table 7) against Cadra cautella and Papilio demoleus has shown that Neemazal 2% Ec was the most effective in reducing the insect population as it elicited maximum toxicity against both the test insects. The LC$_{50}$ value of Neemazal is minimum (0.6046 and 0.6512) with respect of Cadra cautella and Papilio demoleus, respectively.

As regards the toxicity of Neemgold and Bioneem, it different in both the experimental insects. The former proved more toxic than the latter in case of Cadra cautella, whereas, the case was reverse when tested against P. demoleus. It is further noted that Nimbicidine is more toxic as compared to Achook against both storage and phytophagous pests. Uma Shanker (1996) clearly reveal that Bioneem is more toxic than Neemgold against H.armigera. The present finding also upholds the view held by earlier workers and thus found in the full agreement with the results of Ranjana et al. (1999). Ranjana (1999), Studies
on toxicity of various neem based pesticides against C.cephalonica and S.litura reveal that Neemazal was the most toxic formulation and Achook was found to be least effective.

However, in conformity of the present finding, Mathur et. al (1993) reported Achook more toxic than Nimbidicine against Earias insulances. Later, the studies made by Mathur et al. (1996) further confirm their observations regarding the superiority of Achook over Nimbidicine against S.drogotha infesting cotton. The difference in toxicity of Achook and Nimbidicine reported Mathur et al. may differ from the present finding possibly due to the difference in the test insect used and the difference in technique used by the research workers.

5.2 ANTIFEEDING PROPERTIES OF DIFFERENT NEEM BASED PESTICIDES:

Antifeedants plays very significant role in the modern integrated pest management. The act as inhibitor of the gustatory reflexes and consequently function as feeding deterrents because they nither Kill nor repell the pests. In the present study five neem based pesticides used viz., Neemazal, Bioneem, Neemgold, Nimbidicine and Achook.
The results of the experiments showed that Neemazal proved to better in respect of antifeeding effect against Cadra cautella and Papilio demoleus. Critical evaluation of Data (Table 14 and 19) showed that Neemazal gave maximum antifeeding index (83.42) at 2.5% concentration in the case of Cadra cautella. The consumption of leaf area was minimum (13.16) at 2.5 per cent concentration of Neemazal against Papilio demoleus infesting citrus leaves. Overall evaluation of antifeeding effect of different neem based pesticides showed that Neemazal was best antifeeding agent for both the insects i.e. Cadra cautella and Papilio demoleus.

The response of the antifeeding effect of Bioneem was found to be second best against both the test insects. The Bioneem (2.5%) when used against Cadra cautella 88.40 per cent dry mango chipps were protected and even at lowest concentration (0.5%). It could protect 71.67 per cent dry mango chipps. The per cent dry mango chipps consumption was found 13.33% at its 2.5 per cent concentration and thus proved superior to rest of the treatments in case of C.cautella. Similar results have also been seem against P.demoleus, where 84.46 per cent leaf area has been protected at the concentration of 2.5 per
and at minimum concentration of 0.50% elicited 69.85% protection of leaf area of lemon.

Antifeeding properties of Neemgold was found to be third best effective neem based pesticide. A perusal of table 16 and 21 reveal that there was less feeding in Neemgold treated broken dry mango chipps and lemon leaves against C. cautella and P. demoleus, respectively. It can be seen from the table that at the highest concentration antifeeding index was 78.57 against C. cautella and leave per cent protection 84.46% against P. demoleus. Thus, Neemgold proved to be a good antifeeding agent after Bioneem against storage and Phytophagous pests.

As regards Nimbicidine it stands on fourth place in order of antifeeding effect in the present experimentation against both experimental insects. Antifeeding activity of Achook in present investigations was found at the minimum level as compared to the other four neem based pesticides.

A through scan of the literature clearly reveals that considerable work has been done on the antifeeding activity of various plant products as reviewed by Kripa Shankar (1992) and Prasad (1993) including neem, but no one has made attempt to evaluate the antifeeding activity of recently introduced neem
based formulations like Neemazal, Bioneem, Neemgold, Nimicidine and Achook against C.cautella and P.demoleus.

Ranjana et al. (1999) reported that the antifeeding effect of different neem based pesticides against storage pest, Corcyra cephalonica Staint. and Phytophagous pest, Spodoptera litura Fab.

5.3 JUVENOMIMETIC EFFECT OF DIFFERENT NEEM BASED PESTICIDES:

In the present investigations, results have shown that five neem based formulation namely Neemazal, Bioneem, Neemgold, Nimicidine and Achook have induced morphogenetic changes in C.cautella and P.demoleus. A critical observation of experimental finding (Table 29 to 33) revealed that Achook, Nimicidine and other formulations elicited pronounced juvenomimetic effect against both the experimental insects.

Treatment of 3rd instar larvae of C.cautella with oral feeding method resulted in larval-pupal intermediates, deformed pupae and deformed adults. The deformed adults were non-viable with deformed genitelia and unable to produce their off springs further. There was a dose dependent relationship between types
of development of treated insect and the dosage of tested neem formulation. It is also amply documented form the results that percentage of deformed adults of *C. cautella* were more at lower and intermediary concentrations of neem based pesticides. At higher and intermediary dose. The percentage of larval-pupal intermediate at early stage may be due to the presence of more juvenile hormone at the critical period with help in the larval development as also reported by Srivastava and Mathur (1982).

Manifestation of morphogenetic effect of Nimbicidine and Achook used in the present study may be due to presence of Azadirachitin as active compound. The morphological manifestation are quite similar to the finding of Ibrahim et al. (1984). Red Fern et al. (1984) reported that Azadirachtin was least effective as juvenomimetic agent against the nymphs of milk weed bug and pupae of the yellow meal worm due to Azadirachtin treatment.

Other neem based pesticides like Achook, Bioneem and Neemazal have also elicited juvenilization in the treated larvae of *C. cautella*. The sequence of effectiveness of these formulations was found in order as Achook > Neemgold > Bioneem > Neemazal. The present finding was found in agreement with the
results of Singh (1986) who also reported that neem extract cause delayed development. Production of larval-pupal intermediates and even death in many cases at the time of moulting and adult chosen in case T. gregarium. The exhaustive review on juvenomimetic activity of neem based formulations has been presented by Mehrotra and Gujar (1984), Singh (1986) and Devnarayan (1993) against the stored grain and phytophagous pests.

The validity of juvenilizing effect of neem based formulations in the present set of experiment may be compared the many earlier workers as quoted by Bambarker (1990) who attempted to generalise the juvenomimetic effect of neem products.

As regards, the juvenilizing effect of various neem based pesticides included in the present investigation against phytophagous pest, P. demelous, they are more effective than C. cautella Bambarkar (1990) has also demonstrated that azadirachtin acts as a metamorphosis and growth disrupter in S. litura and Helothis armigera. The possible explanation for the variable degree of morphogenetic forms obtained by using different neem based formulations in the present study may be
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because of the variable quantity of azadirachtin present in different neem formulation of course, it warrants detail investigations on the bio-chemical and physiological aspects so as to arrive a definite conclusion.

A deep insight of the data on juvenomimetic effect of Nimbicidine and Achook against P.demoleus clearly reveal that they have the most pronounced morphogenetic effects against the test insect.

In the present experimentation, larval-pupal intermediates were obtained at higher and intermediary dosages of all neem based pesticides. This type of manifestation was found to be dose dependent. The present finding confirms the observations of Mathur and Srivastava (1990) who reported that application of higher dosages of Karanjin induced larval-pupal intermediates in Sarcophaga ruficornis.

The most peculiar deformity in resulting pupae of P.demoleus was the development of deformed pupae which were somewhat irregular in shape with certain depressions on the pupal body. This type of deformity was noticed at medium and lower dosages of all neem based pesticides. The details of the results may be seen in table 29 to 33 under the chapter
“Experimental Findings”. Since this type of effect has been reported in certain restricted insects only, hence, it is most possible to compare this effect with the earlier finding. However, survey of literature reveals that several formulations of neem including azadirachtin resulted pupal deformity in various phytophagous pests as reviewed by Mathur et al (1995). He reported that the juvenilizing effect of Bioneem against Slyepta derogata.

Recently, Ranjana et al. (1999) reported the juvenilizing effect of different neem based pesticides against C.cephalonica and S.litura. These results are similar to the results of present author.

Over all evaluation of the results in respect of juvenomimetic effect of different neem based formulations possess potent juvenomimetic properties against C.cautila and P.demoleus. The morphological changes induced in experimental insects were very similar to JH like effect of the juvenoids. These neem based formulations may further be exploited by undertaking large scale trials as juvenoids in minimizing the population of storage pest, C.cautila and Phytophagous pest,
*P. demoleus* and there after may suitably be incorporated in the integrated management system of these noxious pests.

## 5.4 PERSISTANCE OF NEEM BASED FORMULATIONS:

In the field experimentation for the persistance of different *neem* based formulations against *P. demoleus* it was found that *Neemazal* is most toxic and persistant as it. Continued to give mortality even after 10th day of spraying whereas, *Achook* proved to be the least effective and persistent. However, *Bioneem, Neemgold* and *Nimbicidine* behaved intermediary. Uma Shanker (1996) an persistence of *Bioneem, Neemgold, Nimbicidine* and *Achook* reveal that *Bioneem* has maximum field weathered deposit against *H. armigera* infesting tomato and it has closely followed by *Neemgold, Nimbicidine* and *Achook*.

Ranjana *et al.* (1996) studies the residual toxicity of field weathered deposit of five *neem* formulation viz., *Neemazal, Bioneem, Neemgold, Nimbicidine* and *Achook* against 3rd instar larvae of *S. litura* Fabr. It was found that *Neemazal* formulation has resulted its maximum residual life. It was followed by *Bioneem, Neemgold, Nimbicidine* and *Acoook*, respectively. The present finding are also in conformatory with the result of Ranjana *et al.* (1999). No doubt, Joshi *et al.* (1984)
reported that the **neem** seed kernel suspension at 0.5, 0.75 and 1.0 per cent concentration gave significant protection to tobacco plant against *S. litura* up to 7 days post spray and subsequent studies made by Ram Prasad *et al.* (1984) against *S. litura* demonstrated that even after 9 days of spraying the **neem** seed suspension, it was found effective, but the formulation used by them was altogether different.

**CONCLUSION**

From the overall discussion made on various aspect of different experimental **neem** based pesticides, viz., **Neemazal**, **Bioneem**, **Neemgold**, **Nimbicide** and **Achook**, it may be concluded that **Neemazal** is the best **neem** eco-friendly botanical pesticide against Almond moth, *C. cautella* and Lemon butterfly, *P. demoleus* in terms of toxicity, antifeedant and juvenomimetic compound besides having long persistence. Therefore considering the availability affectivity and safety to environment, **Neemazal** can suitably be exploited for its incorporation in the integrated management of Almond moth *C. cautella* and lemon butterfly, *P. demoleus* under different agro-ecosystem of our country.